ATTACHMENT 6
ROG and NO_X Emissions
Agricultural Burning
San Joaquin Valley

EMISSION INVENTORY SOURCE CATEGORY
Miscellaneous Processes / Waste Burning and Disposal

EMISSION INVENTORY CODES (CES CODES) AND DESCRIPTION
670-660-0262-0000 (47241) Agricultural Burning – Prunings

670-662-0262-0000 (47258) Agricultural Burning – Field Crops

METHOD FOR CALCULATING EMISSIONS

Emissions in this source category come from the open burning of agricultural residues such as crop stubble and orchard prunings. Emissions are calculated from information supplied to the district when the Agricultural Burn permit is issued. This information includes the type and amount of material to be burned, where the burn will occur, and the day of the burn. The district calculates emissions by multiplying the amount of material burned by a crop-specific emission factor. The amount of material burned is usually reported in acres. The number of acres is then converted to tons of material using a fuel loading factor specific to each crop. The district uses the latest emission factor available for each crop type. Emissions are then summed for each county, which can be determined by the location of the burn.

Many of the emission factors used to calculate agricultural burning emissions are based on measurements conducted at the University of California at Davis in 1992 and 1993. When these more recent data were not available, then default emission factors were taken from the U.S. EPA's "Compilation of Air Pollutant Emission Factors", which is often referred to as AP-42. These emission factors are based on ARB sponsored tests performed in 1974 and 1977. Attachment A lists the emission factors.

ROG and NO_X EMISSIONS IN THE SAN JOAQUIN VALLEY

ROG and NO_X emissions are shown below for a typical summer day. However, on days when ozone is high, a no-burn day would likely be declared. No burning would occur on those days.

Summer ROG Emissions (tons per day)

Category	1999	2010
Ag Burning – Prunings	2.7	2.5
Ag Burning - Field Crops	3.3	3.3
TOTAL	**6.0**	**5.8**

Summer NO_X Emissions (tons per day)

Category	1999	2010
Ag Burning – Prunings	1.5	1.3
Ag Burning - Field Crops	0.9	0.9
TOTAL	**2.4**	**2.2**

GROWTH AND CONTROL ASSUMPTIONS

Growth – The growth for prunings was developed from 1986-1998 total non-pasture harvested acreage data by county from CDFA. A regression equation was developed to predict growth using two variables: population and employment in the Farm and Garden Machinery Equipment sector. To predict growth for field crops, a similar attempt was made to develop a regression equation. However, the regression equation was deemed not appropriate for use. Therefore, a no growth assumption was made for years beyond 1998.

Growth Factors

	Prunings	Field Crops
1999	1.000	1.000
2000	0.991	1.000
2001	0.983	1.000
2002	0.974	1.000
2003	0.965	1.000
2004	0.957	1.000
2005	0.949	1.000
2006	0.942	1.000
2007	0.935	1.000
2008	0.928	1.000
2009	0.921	1.000
2010	0.915	1.000

Control No control is applied.

TEMPORAL ACTIVITY

The temporal activity is assumed to occur seven days a week, with uniform activity on weekdays and reduced activity on Saturdays and Sundays. This pattern is represented by code 22. Hourly activity is assumed to occur during daylight hours at varying levels. The highest hourly activity is from 9 a.m. to 5 p.m. with less chance in the early morning and late evening. This pattern is represented by code 37.

Code for Hours per Day	Code for Days per Week	Weeks per Year
37	22	52

The two tables below show how the emissions for burning of prunings and field crops are distributed by month (percent activity) for each county in the San Joaquin Valley. These distributions were developed using the actual date and location of the burn from the Agricultural Burn permit. Although there are wide variations, the burning of prunings generally occurs more in the winter months and field crops in the summer and fall. For estimating summer emissions, the monthly activity is summed for the months of May through October.

Monthly Activity for Prunings (percent)

County	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Fresno	11.2	9.6	10.6	4.5	3.2	3.2	6.1	5.0	6.2	6.3	22.0	12.2
Kern	11.8	8.1	4.9	6.4	1.5	0.8	0.6	2.0	7.0	3.0	30.6	23.4
Kings	4.8	6.2	14.9	19.0	2.9	1.9	1.8	4.0	8.8	4.2	17.2	14.3
Madera	11.6	16.1	15.7	5.6	3.6	2.1	2.0	1.9	1.4	2.3	25.8	11.9
Merced	16.5	13.9	10.2	5.7	3.6	3.8	4.5	2.7	1.1	2.6	15.5	20.0
San Joaquin	12.4	6.7	11.4	7.0	3.2	8.9	4.2	3.0	2.3	2.6	17.0	21.3
Stanislaus	14.4	12.2	15.6	6.6	3.5	3.3	2.6	1.8	1.4	2.4	17.3	18.8
Tulare	7.3	6.3	17.1	10.7	6.2	2.7	4.8	5.3	7.5	6.1	16.4	9.6

Monthly Activity for Field Crops (percent)

County	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Fresno	0.0	0.3	22.5	0.4	0.0	0.9	6.4	0.7	17.7	40.5	5.0	5.6
Kern	1.0	0.0	0.0	0.0	1.8	34.4	29.9	3.5	10.0	14.8	3.7	0.9
Kings	0.5	0.0	0.2	0.0	0.0	0.0	75.3	22.6	1.0	0.0	0.4	0.0
Madera	0.3	0.0	0.0	0.0	0.0	10.3	39.1	0.0	1.5	18.5	26.0	4.3
Merced	0.7	0.0	16.5	0.2	1.1	9.8	6.2	1.8	8.3	37.5	17.4	0.4
San Joaquin	0.9	4.0	12.0	25.5	1.1	3.9	7.4	2.2	4.2	15.3	20.0	3.6
Stanislaus	0.0	0.1	55.0	16.7	3.9	2.8	0.3	0.4	0.6	3.1	15.1	2.1
Tulare	0.5	0.0	1.1	0.0	1.8	13.9	31.3	5.9	10.1	14.0	18.3	3.1

FUTURE IMPROVEMENTS

The San Joaquin Valley Unified APCD (SJVUAPCD) recently hired a new staff person whose first task will be to recalculate the agricultural burning emissions from 1997 through 2000 using the latest emission factors available. The SJVUAPCD is also developing methods of using geographic information systems (GIS) to better track the locations of agricultural burning. In addition, they have released a contract to create an automated phone-based system to better manage agricultural burning in the SJV.

ATTACHMENT A

Emission Factors for Open Burning of Agricultural Residues

Crop	NOx (lb/ton)	VOC (lb/ton)	Source of Data
Row Crops			
Alfalfa	4.5	21.7	NOx-1992/93;VOC-1974/77
Barley	5.1	15.0	1992/93
Corn	3.3	6.6	1992/93
Oats	4.5	10.3	NOx-1992/93;VOC-1974/77
Rice	5.2	4.7	1992/93
Safflower	4.5	14.8	NOx-1992/93;VOC-1974/77
Sorghum	4.5	5.1	NOx-1992/93;VOC-1974/77
Wheat	4.3	7.6	1992/93
Orchard and Vine Crops			
Almond	5.9	5.2	1992/93
Apple	5.2	2.3	NOx-1992/93;VOC-1974/77
Apricot	5.2	4.6	NOx-1992/93;VOC-1974/77
Avocado	5.2	18.5	NOx-1992/93;VOC-1974/77
Bean/Pea	5.2	14.2	NOx-1992/93;VOC-1974/77
Cherry	5.2	6.0	NOx-1992/93;VOC-1974/77
Citrus	5.2	6.8	NOx-1992/93;VOC-1974/77
Date palm	5.2	3.8	NOx-1992/93;VOC-1974/77
Fig	5.2	6.0	NOx-1992/93;VOC-1974/77
Grape	5.2	3.8	NOx-1992/93;VOC-1974/77
Nectarine	5.2	2.3	NOx-1992/93;VOC-1974/77
Olive	5.2	10.3	NOx-1992/93;VOC-1974/77
Orchard	5.2	6.3	1992/93; 1974/77
Peach	5.2	3.0	NOx-1992/93;VOC-1974/77
Pear	5.2	5.1	NOx-1992/93;VOC-1974/77
Prune	5.2	4.6	NOx-1992/93;VOC-1974/77
Walnut	4.5	4.8	1992/93